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Barriers to Pediatric Sickle Cell Disease Guideline Recommendations

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Abstract

National guidelines recommend that providers counsel all patients with sickle cell anemia about hydroxyurea (HU) therapy and screen children with sickle cell anemia annually for the risk of stroke with transcranial Doppler (TCD). We surveyed a national convenience sample of sickle cell disease clinicians to assess factors associated with low adherence. Adherence was 46% for TCD screening. Low adherence was associated with a lack of outcome expectancy (eg, a belief that there would be poor patient follow-up to TCD testing; $P < .05$). Adherence was 72% for HU counseling. Practice barriers (eg, lack of support staff or time) and a lack of agreement with HU recommendations were associated with low adherence ($P < .05$). This study demonstrates that different types of strategies are needed to improve TCD screening (to address follow-up and access to testing) versus HU counseling (to address physician agreement and practice barriers).

Keywords

clinical practice guidelines, adherence, physician practice patterns

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Introduction

The 2014 National Heart Lung and Blood Institute (NHLBI) Expert Panel Report on the *Evidence-Based Management of Sickle Cell Disease* (SCD) was developed to provide "the best science-based recommendations to guide practice decisions."[1] In general, clinical practice guidelines should improve quality of care by expediting the application of new therapeutic advances and decreasing inappropriate clinical variation. However, many barriers to clinician guideline adherence have been described, which prevent the consistent application of guideline recommendations in everyday practice.[2] Understanding such barriers specific to the application of the NHLBI Sickle Cell Disease guidelines can help those involved in guideline development, guideline implementation, and quality improvement.

We focused on 2 specific guideline recommendations for sickle cell anemia (SCA; which refers to HbSS or Hb-Sβ^0-thalassemia), which are the current focus of quality measure development. The NHLBI guidelines recommend that providers "educate all patients with SCA and their family members about hydroxyurea therapy."[1(p77)] The guidelines also recommend that providers "screen annually" for the risk of stroke with transcranial Doppler (TCD) for children with SCA based on the protocol from the STOP (Stroke Prevention Trial).[3] Children with high-risk TCD should then be started on chronic red cell transfusions (CRCT).[1(p21)] Although both recommendations are included in the same guidelines, we hypothesized that since each recommendation focuses on a different aspect of care, there would be

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different barriers to adherence that would be necessary to address for successful implementation.[2]

We conducted a cross-sectional survey of a national convenience sample of clinicians involved in SCD management in children to assess barriers to SCD guideline adherence. Understanding these barriers may provide insight into how to support consistent provider adherence and improve the quality of SCD care.

Methods

Participants

We contacted physicians involved with the Pacific Sickle Cell Regional Collaborative (PSCRC) or the Dissemination and Implementation of Stroke Prevention: Looking at the Care Environment (DISPLACE) study. The PSCRC is composed of 15 clinical sites in the Western United States and is 1 of 5 regional clinical collaboratives funded by the US Department of Health and Human Services, Health Resources and Services Administration Sickle Cell Disease Treatment Demonstration Program. DISPLACE is a national multicenter study including 28 sites in the United States based at the Medical University of South Carolina to assess and improve stroke prevention implementation for SCD. Including providers involved in both the PSCRC and DISPLACE results in a broad, national convenience sample of clinicians closely involved in SCA patient care.

We excluded clinicians-in-training and clinicians who spent the majority of their professional time outside of clinical practice (ie, administration, research). Between January and August 2018, we sent a cover letter, an 8-page questionnaire, and a prepaid return envelope to each potential participant. We also provided access to a web-based version of the survey. Nonrespondents received up to 3 reminders to complete the survey. We did not offer an honorarium for participation. The Committee on Human Research at the University of California, San Francisco, approved the study.

Survey Instrument

The survey instrument asked clinicians to indicate their level of adherence as well as barriers to adherence. The NHLBI Sickle Cell Disease guidelines recommend that patients with SCA from 2 to 16 years of age receive annual TCD screening and that patients with SCA who are ≥9 months of age be offered guidance regarding treatment with hydroxyurea (HU).[1] Our outcome of interest was provider self-reported adherence to these 2 recommendations. The latter recommendation applied to both adult and pediatric providers. We asked, "For what percentage of your patients with sickle cell anemia (SCA) who are ≥9 months of age do you or someone in your practice (nurse, colleague) offer patients/parents guidance regarding treatment with hydroxyurea?" In addition, for those providers whose practices also include children, we also asked, "What percentage of patients with SCA in your practice, ages 2 to 16 years, receive annual TCD measurements?"

For each of the 2 recommendations, clinicians indicated their level of adherence. Respondents from DISPLACE sites indicated their level of adherence with 1 of 5 possible responses: "less than half of the time" (<50%), "just over half of the time" (51% to 75%), "most of the time" (76% to 90%), "almost all of the time" (91% to 99%), and "all of the time" (100%). Respondents from PSCRC sites indicated their level adherence with 1 of 5 possible responses: "1% to 25%," "26% to 50%," "51% to 75%," "76% to 90%," and "91% to 100%."

We asked about factors associated with clinician guideline adherence, including access to the guideline (Yes/No); familiarity with the specific guideline component (1, not at all familiar; 5, extremely familiar); agreement with the component (1, strongly disagree; 5, strongly agree); and self-efficacy, which is defined as one's confidence in the ability to perform the guideline component (1, not at all confident; 5, extremely confident).[2] In terms of practice barriers, we asked about the significance of potential issues (1, not at all significant; 4, extremely significant), such as lack of equipment or clinic space, lack of time during a patient visit, lack of educational materials, lack of support staff, and lack of reimbursement for services.[2]

Self-efficacy was defined as the clinician's confidence in his/her ability to perform a guideline component. Since some components might require multiple skills, we measured self-efficacy for each skill required for following each component. For the recommendation of TCD screening, we measured self-efficacy for 2 skills: interpret the results of TCD screening and apply the results of TCD screening to guide patient management. Self-efficacy for TCD screening was present if clinicians indicated that they were "very" or "extremely" confident for both components. For the recommendation of HU counseling, we measured self-efficacy for 3 skills: recognize which patients may benefit from treatment with HU, prescribe the appropriate dosage and schedule of HU, and recognize the side effects of treatment with HU. Self-efficacy for HU counseling was present if clinicians indicated that they were "very" or "extremely" confident for all 3 components.

We asked respondents if they had concerns (none, slightly significant, moderately significant, or extremely significant) about patient TCD adherence or access to testing, as well as HU adherence or access. A clinician's

outcome expectancy is the belief that if a recommendation is followed by the clinician, a desired outcome will occur (eg, improved patient outcomes). For TCD screening, lack of outcome expectancy was present if the physician indicated that they had "moderately significant" or "extremely significant" concerns regarding patient TCD adherence or access to testing. For HU counseling, lack of outcome expectancy was present if the physician indicated that they had "moderately significant" or "extremely significant" concerns regarding patient HU adherence or access.

Finally, we asked about demographic data including year of completion of highest level of training, practice setting (eg, solo, academic institution, group practice, federal practice, or health maintenance organization), academic affiliation (yes/no), number of patients with SCA in the clinician's patient panel, and type of board certification.

Analysis

For each of the guideline recommendations, our dependent variable of interest was self-reported physician adherence. We considered physicians as *adherent* if they reported following the guideline component >90% of the time, based on previous definitions of adherence.[4] For the analysis of factors associated with self-reported adherence, we dichotomized the responses. A factor was present if clinicians answered 4 or 5 on a 5-point Likert-type scale; or 3 or 4 on a 4-point Likert-type scale. For example, clinicians were considered familiar with a guideline component if they indicated that they were "very" or "extremely" familiar with the component in question.

We used Fisher's exact test or Student's *t* test to compare each of the independent variables (demographic characteristics, practice characteristics, and hypothesized barriers to adherence) with physician self-reported adherence to the guideline component in question. Stata 15.0 (StataCorp LLC, College Station, TX) was used for all analyses.

Results

Of the 64 eligible respondents, 43 (67%) returned our questionnaire. The majority (91%) of respondents cared for both pediatric and adult patients with SCA. Demographic and practice descriptions of survey respondents are summarized in Table 1. All respondents were board certified in pediatrics or internal medicine. Respondents had additional board certification in pediatric hematology (77%), adult hematology (5%), and transfusion medicine (5%). The majority practiced in academic medical centers and had practice panels with more than 200 patients with SCD. The respondents were an experienced group of clinicians, as the mean number of years since training was 25 years.

Table 1. Clinician and Practice Information.

	Number (%)
Practice type	
Academic medical center practice	38 (88%)
Group private practice	2 (5%)
Federal (military or publicly funded)	1 (2%)
Other	2 (5%)
Number of patients with sickle cell disease	
1-20	4 (10%)
21-100	5 (12%)
101-200	7 (17%)
More than 200	26 (62%)
No response	1 (2%)
Years since completion of highest level of training (n = 42)	
1-10 years	2 (5%)
11-20 years	14 (36%)
21-30 years	12 (29%)
31-40 years	12 (29%)
More than 40 years	2 (5%)
Board certification[a]	
Pediatrics	31 (72%)
Internal medicine	4 (9%)
Pediatric hematology	33 (77%)
Adult hematology	2 (5%)
Transfusion medicine	2 (5%)

[a]Respondents could provide multiple responses; thus, totals are >100%.

Self-Reported Adherence Frequencies

Due to incomplete questionnaires, not all totals are equal in the analysis of each guideline component. In terms of self-reported adherence, 17 of 37 (46%) respondents reported being adherent to the TCD screening recommendation. Thirty-one of 43 (72%) respondents reported being adherent to the HU counseling recommendation.

Guideline Awareness and Access

All 43 respondents (100%) reported having access to a copy of the 2014 NHLBI Sickle Cell Disease guidelines. Thirty-five (81%) reported being either very familiar (47%) or extremely familiar (35%) with the guidelines. Respondents learned about the guidelines by reading a copy (91%), attending continuing medical education (12%), and learning about the guideline from a physician (21%) or nonphysician colleagues (2%). Other

Table 2. TCD Screening Barriers and Association with TCD Adherence (N = 37).

	Total (N = 37)	Nonadherent (n = 20)	Adherent (n = 17)
Lack of familiarity with recommendation	1 (3%)	0	1
Lack of agreement with recommendation	4 (11%)	4	0
Lack of self-efficacy			
To interpret TCD results	12 (32%)	6	6
To apply TCD results to guide therapy	8 (22%)	5	3
To interpret *or* apply TCD results	14 (38%)	8	6
Lack of outcome expectancy*	18 (49%)	13	5
Presence of external barriers			
Lack of equipment or space	5 (14%)	4	1
Lack of time	8 (22%)	5	3
Lack of educational materials	1 (3%)	1	0
Lack of support staff	10 (27%)	7	3
Lack of reimbursement	2 (5%)	2	0
Other issues	7 (19%)	4	3
Lack of one or more of the above	14 (38%)	8	6

Abbreviation: TCD, transcranial Doppler.
*$P < .05$ based on Fisher's exact test.

sources included involvement in the development or review of the guidelines (12%), involvement in clinical trials (5%), non–continuing medical education conferences (2%), other administrative work (2%), and social media (2%). Since respondents could indicate more than one answer, the totals are greater than 100%.

Barriers to TCD Adherence

Thirty-seven respondents completed all questions associated with TCD screening practices. Table 2 describes the prevalence of each barrier and the association with TCD adherence. Overall, providers were familiar with (97%) and agreed (89%) with the recommendation.

Approximately one third of respondents (38%) reported a lack of self-efficacy in terms of interpreting and/or applying TCD results. Similarly, 38% of respondents also reported the presence of external practice barriers. The most common issue was lack of support staff. Seven other issues mentioned included "limited radiology schedule" (n = 2), "obtaining accurate TCD interpretations from radiologists" (n = 2), "difficulty tracking prior TCD results" (n = 1), "difficulty coordinating visits with TCD" (n = 1), and "locations; radiology not close to sickle clinic" (n = 1).

The most common barrier reported was a lack of outcome expectancy (49%). Outcome expectancy was low if the respondent indicated that following the recommendation and ordering a TCD would be unlikely to affect patient outcomes (eg, due to concerns regarding patient access to TCD testing or due to concerns that the recommendation for CRCT if TCD was abnormal was unlikely to be followed by the patient/family). Unlike other barriers, the presence of this barrier was significantly associated with nonadherence to TCD recommendations ($P < .05$). There was no association between size of practice, years since training, or practice setting with adherence to TCD recommendations ($P > .05$).

Barriers to HU Adherence

Forty-three respondents completed all questions associated with HU counseling practices. Table 3 describes the prevalence of each barrier and the association with HU adherence. In general, providers were familiar with (93%) the recommendation.

The most common barrier was lack of self-efficacy, which was reported by almost half (49%) of the respondents. Potential issues include recognizing which patients may benefit from HU (30%), prescribing the appropriate dose (28%), recognizing side effects (28%), or discussing the risks of the therapy with patients/families (37%). Almost half (44%) of respondents reported low outcome expectancy, which was associated with concerns about patient adherence to following the regimen.

Approximately one third (30%) of respondents also reported the presence of external practice barriers to HU counseling. The presence of one or more practice barriers was significantly associated with lack of provider adherence to HU counseling recommendation ($P < .05$). The most common issue was lack of support staff (16%) to assist with counseling. One other issue mentioned in the open-ended responses included "lack of digital resources for distribution" (n = 1). Only 5 respondents (12%)

Table 3. HU Counseling Barriers and Association with HU Adherence (N = 43).

	HU Counseling (N = 43)	Nonadherent (n = 12)	Adherent (n = 31)
Lack of familiarity with recommendation	3 (7%)	0	3
Lack of agreement with recommendation*	5 (12%)	4	1
Lack of self-efficacy			
To recognize which patients may benefit from HU	13 (30%)	6	7
To prescribe appropriate dose and schedule of HU	12 (28%)	6	6
To recognize side effects of HU	12 (28%)	6	6
To discuss risk of possible HU side effects with patients/parents	16 (37%)	7	9
To at least one of the above (eg, recognize which patients may benefit, prescribe HU, recognize side effects, or discuss HU risk)	21 (49%)	8	13
Lack of outcome expectancy	19 (44%)	7	12
Presence of external barriers			
Lack of equipment or space	3 (7%)	2	1
Lack of time	6 (14%)	2	4
Lack of educational materials	6 (14%)	3	3
Lack of support staff*	7 (16%)	5	2
Lack of reimbursement	5 (12%)	3	2
Other issues	1 (2%)	0	1
Lack of one or more of the above*	13 (30%)	7	6

Abbreviation: HU, hydroxyurea.
*$P < .05$ based on Fisher's exact test.

indicated a lack of agreement with the HU counseling recommendation; however, this was associated with a lack of adherence to the recommendation ($P < .05$).

There was no association between size of practice, years since training, or practice setting with adherence to HU recommendations ($P > .05$).

Discussion

We systematically examined barriers to provider knowledge, attitudes, and self-reported adherence to NHLBI guideline recommendations for TCD screening and HU counseling in a group of experienced providers caring for individuals with SCD. Self-reported adherence rates (defined as following recommendations for >90% of cases) were only 72% for HU counseling and 46% for TCD screening. In addition, our analysis builds on previous work, as we found that these 2 different guideline components have a distinctive combination of barriers to adherence. These findings have implications for developing practice interventions to more easily facilitate implementation of guideline-based therapies and SCD quality of care.

Although there were many different barriers to TCD screening, the one barrier significantly associated with low provider adherence was lack of outcome expectancy. In this case, low outcome expectancy was associated with provider concerns that even if TCD screening was ordered and scheduled, the likelihood of patients actually following-up was perceived to be low or that families would be unlikely to commit to CRCT if TCD was abnormal. Additional information from open-ended questions in the survey describe other practice-related barriers that may make implementation of TCD screening and follow-up difficult for patients/families. Providers indicated limited access, proximity, or ability to coordinate patient care visits for SCD with TCD examinations at radiology clinics as specific barriers. There were also concerns related to obtaining timely and accurate TCD interpretations.

These results are similar to the results of a National Provider Survey conducted prior to the publication of the 2014 guidelines. Specifically, providers reported that the distance to travel for testing and low patient adherence were barriers to TCD screening.[5] Successful TCD screening requires multidisciplinary care, which can be difficult to coordinate across different settings. In addition, from a patient perspective, additional testing may require that patients go to a separate radiology center on a different date, causing additional transportation burden and time away from work, which can decrease the likelihood of adherence.

Quality improvement methods to develop and implement a coordinated system for obtaining and improving the rates of initial TCD screenings for young children

have been used and documented in a large health care system.[6] Incorporation of TCD screening within comprehensive SCD clinics during a comprehensive visit may be another strategy to improve patient adherence, outcomes, and satisfaction.[7] However, this approach may require a significant patient panel size to be cost-effective or practical.

Improving parent/family understanding of the importance of TCD screening and initiation of CRCT may help improve patient/family engagement and thus provider outcome expectancy regarding TCD screening. Interviews with families suggested that improving knowledge about the purpose of TCD screening and greater empowerment may help improve annual TCD follow-up.[8] In addition, the use of personalized reminders to families and additional information about screening have been used as a quality improvement intervention to increase the rate of TCD screening.[9]

For HU counseling, we found that low adherence was associated with lack of provider agreement with the recommendation. In 2008, a survey of health care providers noted that lack of awareness and lack of agreement regarding HU benefits was associated with HU underprescribing.[10] Although lack of awareness was less common in our current study, the presence of lack of agreement still seems to be associated with poor HU recommendation adherence. Previously reported provider concerns about HU include the potential carcinogenic issues, doubts about HU clinical effectiveness, and potential adverse effects.[11]

Interventions to address issues with provider agreement include endorsement by local opinion leaders or specialty societies.[12,13] Opinion leaders are defined as members of a local community who influence the community acceptance of new ideas or therapies, such as a guideline.[12] Providers tend to adhere to guidelines developed by their own specialty organization.[13] The American Academy of Pediatrics and the American Society of Hematology endorsed the NHLBI SCD guidelines in 2014.[14,15] As a result, emphasizing the endorsement of these guidelines by pediatric or internal medicine professional societies might improve guideline agreement by pediatricians and internists, respectively.

The presence of practice barriers, such as the lack of support staff, was also associated with low HU counseling. Patients and families may have a variety of different medication concerns (eg, potential side effects, overuse of medications), which are closely associated with long-term HU medication adherence.[16] As a result, it can be challenging to educate, counsel, and coach patients regarding chronic medications during the limited time of an outpatient visit. The presence of additional support staff can help improve clinic efficiency. In addition, there are interventions and counseling techniques that have been used to help improve clinician counseling and education efficacy for patients with chronic disease.[17]

Limitations

The survey was conducted with a convenience sample of SCD providers from the United States, who do not represent a random, national sample of SCD providers. These providers are likely to be more interested and involved in SCD clinical trials and/or work at clinics more likely to be tailored for SCD treatment. As a result, the likelihood of practice barriers may be even higher in a more general sample. We relied on provider self-report of adherence, which might not reflect actual practice. However, our purpose was to investigate if different SCD guideline recommendations are associated with different barriers. Even if self-report overestimates adherence, it is unlikely to affect the relationships of the types of barriers associated with nonadherence. In addition, the fact that 12% of the respondents reported being involved in the development or review of the NHLBI guidelines is concerning, as these respondents may be biased in terms of following the guidelines. However, despite this limitation, which may inflate guideline adherence, there was still a low rate of adherence to TCD screening for SCD (46%), as well at the relatively low rate (72%) for HU counseling.

In addition, another limitation is the terminology used in describing how HU should be discussed with families. The guidelines state that providers should "educate" about HU therapy, but the guidelines further describe some specific topics that should be "counseled" (eg, not to double up on doses). In our survey instrument, we asked physicians how often they "offer patients/parents guidance regarding treatment with hydroxyurea." Although the terms "educate," "counsel," and "offer guidance" all suggest different aspects of shared decision-making, the lack of a single, concise term to capture the recommendation could lead to different interpretations of the action by the respondents and different estimates of how often the action occurs in practice.

Finally, we can only report on a respondents' *perception* of the barrier, which may not be an accurate reflection of how problematic or prevalent a barrier is. However, our goal was to also help identify potential interventions to improve adherence. Whether the problem is actual or perceived may also affect the type of intervention needed to overcome the barrier.

Implications

In conclusion, although providers seem to be well aware of the existence of the NHLBI SCD guidelines,

there are many barriers to their successful use. These results have implications for selecting interventions to improve SCD practice. Interventions should be tailored to the guideline recommendation being addressed. For example, the factors associated with adherence to HU counseling suggest a need to address provider agreement with the recommendation, as well as methods to improve HU counseling during the clinic visit. To improve TCD screening, this study suggests that improving parent/family understanding of the importance of TCD and making TCD screening more accessible and coordinated with SCD visits may be the most important issues associated with guideline adherence.

Authors' Note

Parts of this study were presented at the American Society of Pediatric Hematology/Oncology (ASPHO) 2018 Annual Meeting; May 2, 2018; Pittsburgh, Pennsylvania.

Author Contributions

The study was conceptualized by MDC. The survey instrument was developed by MDC, MJT, AM, JK and NSB. The analysis was conducted by MDC, JK and NSB. All of the authors critically reviewed and edited the text.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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